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Washington Park

ARBORETUM BULLETIN

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Concerning This Issue...

The *Arboretum Bulletin* has been launched into the computer age. This is the first issue which has been edited, type-set, and pasted-up entirely on a computer. Please excuse the bugs - they will be worked out by the fall issue. Computerization is part of the process to increase the quality of the *Bulletin* while simultaneously lowering costs.

Somewhat dichotomous to computers, this issue contains an in-depth article about the venerable bamboo. Daphne Lewis, famed local bamboo grower, presents her second article on bamboo - this time concentrating on those genera growing in Seattle.

Dr. Clement Hamilton has written an introduction to world climate and the use of the Walter climate diagram system. This is the first in a series of articles which will explore particular geographic regions and their plants as represented in the Washington Park Arboretum.

The black & white photo winners of the Arboretum Foundation Photography Contest grace the center part of this issue. Perhaps in a future edition we will be able to publish the winning color photos as well.

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Washington Park

Arboretum Bulletin

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Choice Award", Arboretum
Foundation Photo Contest

Semiarundinaria fatuosa
drawing by Sylvia Chesley Smith

An Introduction to Bamboo
Part II, Common Bamboos in Seattle

DAPHNE LEWIS

Daphne is a landscape designer specializing in gardens that feature bamboo.Her business, the Bamboo Brokerage, buys, sells, maintains, and installs bamboo.

Each year the American Bamboo Society publishes its "Source List", an 8 page pamphlet which briefly discribes all the bamboos available in the United States and where they may be obtained.[1] The 1986 "Source List" shows ten genera (73 species) of bamboo that are hardy in Seattle. The five genera that are common in Seattle are *Phyllostachys*, *Arundinaria*, *Semiarundinaria*, *Sasa* and *Pseudosasa*. They can be collected by keeping one's eyes and ears open to locate them in a friend or strangers' yard and then getting permission to dig. One very successful collector is a driver for United Parcel Service who continually discovers bamboo in customers' yards and asks other drivers on different routes to report their finds to him. The best collection of bamboo is at the Woodland Park Zoo - ask for a map of the bamboos as you enter.

Common Bamboos in Seattle

Phyllostachys
P. aurea - Golden or Fishpole
P. aureosulcata - Yellow Groove
P. aureosulcata v. 'alata' - Alata
P. flexuosa - Flexuosa
P. nigra - Black
P. nigra v. 'Henon' - Henon

Arundinaria
A. argenteostriata - Argenteostriata
A. chino v. 'Vaginata variegta' - Chino variegata
A. humilis
A. pygmaea - Pygmy bamboo
A. variegata - Dwarf Whitestripe
A. viridi-striata - Viridi-striata

[1]The "Source List No. 6, April, 1986" lists 23 sources, 12 of which will ship. It can be obtained free of charge by sending a self-addressed, stamped envelope to the American Bamboo Society, 1101 San Leon Court, Solana Beach, Calif. 92075.

*B*amboo *planting at Kirsten Gallery. A lovely little garden in a busy commerical district.*

photo: Joy Spurr

Semiarundinaria
S. fastuosa - Fastuosa
Sasa
S. palmata - Palmata
S.veitchii - Veitchii
Pseudosasa
P. japonica - Arrow Bamboo

Phyllostachys

When one thinks of hardy bamboo, one is normally thinking of *Phyllostachys*, the timber bamboo of Japan and China. This genus has a light and feathery look because it has only two branches at each node. This characteristic makes it a beautiful plant to look at and to look through.

Phyllostachys are running bamboos, as are most genera of hardy bamboos. They have the ability to spread rapidly underground by rhizome extention. In this respect they resemble perennial bluegrass. The genus is easy to distinguish from other genera of running bamboos by two vegetative characteristics; 1) branches are arranged in pairs just above the node on alternate sides of the culm. Sometimes there is a small third branch between the two main ones. Branches of other runners are either single or three or more branches at the node, and 2) a distinct groove runs from node to node on alternate sides of the culm above the branches.

Species of Phyllostachys can be mid-to-giant in size. For example the most common, P. aurea, or golden, is a mid-sized bamboo that can grow as tall as 27 feet with a diameter of 1.75 inches. The most common of the timber bamboos, P. nigra 'Henon', can grow up to 54 feet tall with a diameter of 3.5 inches.

Culture

The species of *Phyllostachys* which I mention in this article grow best in full sun, although they will succeed on the north side of a house or stand of trees. The exception is black bamboo, *P. nigra* , which does best when protected from hot southwest sun.

They prefer continually moist, but well-drained soil. However, I have

seen them thriving with their rhizomes two inches above the surface of a stream and also growing moderately well on compacted, dry, clay soil. The plant is a survivor.

To obtain a fast-growing grove, with the largest diameter culms, it is important to dig a deep bed, to enrich it generously with organic matter rich in nitrogen and to water it heavily all summer long. For example, a small start of *Phyllostachys vivax*, a timber bamboo, planted with copious chicken manure dug into the bed and laid as mulch on top, went from 3 shoots with diameters of half an inch to 40 shoots of 2 inch diameters in three summers. I have read in the *Journal of the American Bamboo Society* that no one has ever over-fertilized or over-watered bamboo, provided the soil is drains well. Of course once the bamboo is as big as the owner desires, it makes sense to stop watering and fertilizing.

Another cultural technique that encourages large diameter culms is to reduce the number of culms in a grove because the plant produces fewer and thinner diameter shoots when the culms crowd each other. It is best to thin the grove by cutting out, at the ground, the old and small culms. If the culms still crowd each other, thin the grove further by cutting culms according to aesthetic and practical considerations.
Phyllostachys is tall relative to its root mass. A specimen that is 20 to 30 feet tall can be transplanted because the rootball will still be small enough so that one person can carry the roots while another is carrying the branches and culm.

Uses In the Landscape

All of the species of *Phyllostachys* have the following landscape uses:

* For a tall, slender screen between the viewer and an unwanted view.
* To give an oriental or tropical atmosphere to a garden.
*To "hide" street noise with the bamboo's rustling leaves.
*To provide garden stakes and wood for construction.

Phyllostachys aurea, *golden bamboo.*
drawing: Sylvia Chesley Smith

*To provide edible shoots for soups and stir fry dishes.
*To form a fast growing, low-maintenance, formal hedge. When trimmed like a privet hedge, *Phyllostachys* becomes dense and leafy. Since it only shoots in May and June, it needs less maintenance than other formally pruned plants.
*To be an accent, or specimen plant.
*To form a grove to walk through,sit in, or meditate under.
*To form a tall green background for other plants.
*To control erosion: hold hillsides, banks, etc.

P. aurea , Golden Bamboo or Fish Pole Bamboo,27';1.75";-5º

Golden bamboo is the most common in Seattle. Usually its culms are light green. However like many *Phyllostachys*, the culms can turn light green or golden when exposed over time to the sun. The leaves are always greenexcept in rare varieties with white and green variegated leaves.

Golden bamboo is readily identified

Phyllostachys nigra, *the mature black culms. East of the Orangatan House,Woodland Park Zoo.* *photo: Joy Spurr*

Young green culms of Phyllostachys nigra *'negurochiku'. North of the Ogangatan House.* *photo: Joy Spurr*

by two distinctive characteristics of its culms; 1) under each node beginning at the sheath scar is a thickening of the node, (to me it looks like a turtleneck just under the node) and, 2) somewhere on the culm, usually near the base, there are shortened internodes. These shortened internodes form a tortoise shell pattern that can be quite stunning, however not every culm has this quality.

This species of bamboo withstands root constriction relatively well and therefore can be grown in pots and small areas. It tends not to run in dry compacted soil and to run less in Seattle than in California. It can be confined to one place (as can most bamboo) with a barrier such as fiberglass set two feet deep intot he soil.

Golden bamboo in Seattle is usually under 15' tall and less than an inch in diameter when grown without the advantage of thinning, irrigation or fertilizer. It survives neglect and poor conditions. If you like it bigger then thin it, give it loose soil with plenty of room to spread, treat it with chicken manure and copious water and stand back-it will get big.

P. nigra, Black Bamboo,30'; 2" ø, 0º

Black bamboo is the stunning bamboo with black culms and small green leaves that is familiar to many gardeners. I think it is a plant whose beauty is evident close up, but which is perhaps less effective from a distance than the green culmed species. It has a delicate beauty when grown with slender culms spaced well apart. It is majestic when 30 feet high with 2" culms.

Thinning the culms is important because it allows the plant to grow into a grove insead of a thicket. It also reduces the outward bending of the perimeter culms which can arched out significantly as a result of interior branches pushing against them. Black bamboo is more apt to show leaf damage from winter winds and summer

drought than the other *Phyllostachys* species.

The young culms are green and turn black after more than a year so a mature grove has a mixture of black and green culms.

P. nigra **v. 'Henon'**, Henon or Hachiku,54'; 3 1/2"; 0ºF

Henon, despite its species name, is green. If you want a very tall, very graceful, very beautiful bamboo, this is it.

Henon's shoots are clothed in culm leaves that have crinkled and purple blades.(See drawing on page 10.) The auricles and oral setae are purple as well, and prominent. Gardeners seeing the shoots sometimes think it is a different bamboo altogether because as the new shoot has matures, the culm leaves fall off, and is an elegant and fresh green, with white powder around the nodes. It is rough to the touch because there are small hairs that later fall off.

A variety of Henon found only in Seattle is meguro chiku. It has a black or brown groove and is extremely rare in Japan.

P. aureosulcata , Yellowgrove, 26';1.5";-10º

Yellow groove is one of the hardiest *Phyllostachys*. It can be recognized from a distance because some of the culms will have a distinct crook at the bottom. When the culms are bleached light green from sun the yellow grooves are not prominent, but on a fresh green shoot the groove makes an attractive alternating pattern of green and yellow.

P. aureosulcata **v. alata**, Alata,30'; 2"; -10º

Members of the Pacific Northwest Chapter of the American Bamboo Society misidentified a stand of alata in Seward Park as Henon because it was so big. Clumps of it were laboriously moved to the Zoo to a planting area south of the primate house. A year later when the shoots started coming up pale

Phyllostachys aureosalcata v. alata, *in section "O" at the Woodland Park Zoo.*
photo: Joy Spurr

green with many slender whitish stripes, we realized that it was not Henon, but a yellow groove without the yellow coloration or distinctive crook at the base.

P. flexuosa , Flexuosa,31';2.75"; 0ºF

The culms of this plant are sometimes straight from node to node but more typically are slightly zigzag and sometimes are very zigzag. Hence the name flexuosa. The plants I have seen are beautifully graceful and very green.

Arundinaria

Arundinaria species are hardy, small-to-medium sized running bamboos with slender culms which are round in cross section. They have one to numerous branches arising at the node. The culm leaf is persistent. The arundinarias that are common to Seattle are small bamboos although there are some large ones available. They spread rapidly and are easily propagated.

Culture

The small arundinarias are native to China and Japan. They grow well in light shade but if given too much they can become leggy and have oversized leaves. They are not particular as to soil and are vigorous, aggressive spreaders. Many of these are more attractive if mowed down once a year to encourage new, thick leaves.

Uses in the Landscape

Plant them in pots for their colorful evergreen foliage. Bonsai them as miniature bamboo groves. Contain them in the ground to use as specimens or grow them uncontained to form colorful masses that can help to control erosion. They cover the ground and contol weeds more rapidly than does juniper and maintain their good looks through more of the year than do orchard grasses (and unlike ivy they do not climb).

A.Argenteostriata , 3'; .25"; 10ºF

This *Arundinaria* is striking as a specimen. The narrow leaves are green-striped with white and are hairless on both surfaces.

***A. Chino* v. 'vaginata variegata'**, 6'; .5"; 10ºF

A slow spreader, *A.C.* v. 'vaginata varigata' has white and green-striped leaves that are narrow and form an active pattern.

A. humilis, 4';.18"; 0ºF, 3/4" x 8" leaves.

A. humilis has attractive dark green leaves. It is an aggressive spreader. Use it as a groundcover for large areas and to control erosion.

A. pygmaea 2';.18";10ºF

This species has small, two ranked leaves that are hairy on the underside. Other small bamboos are often sold under this name. Use it as groundcover or in containers. This plant can be mowed to remain at a few inches in height and creates a striking dark green groundcover, especially when used under timber bamboo that has been pruned so each culm is 3 or more feet apart.

A. variegata , Dwarf White Stripe Bamboo, 4'; .25"; -10ºF

This handsome Japanese bamboo usually has a single branch at the node, sometimes two. The leaves which are softly hairy on lower surface, are 2 to 6 inches long and up to one inch wide. Some leaves are white with green stripes and some are green with white stripes.

The foliage is plentiful and clusters at the tips of culms and branches. It is an ideal container plant.

A. viridi-striata, 3';.25"; 0ºF

This is a softly beautiful plant. The leaves come out striped yellow and chartreuse in spring with velvety pubescence underneath and then turn green by the end of summer. The leaves burn in the sun and it can look scruffy in winter.

Semiarundinaria

S. fatuosa , Narihira bamboo,30'; 1.5"; -5ºF

This is an outstanding plant for urban gardens. Normally in Seattle it is 15 feet tall. The culms are upright with little or no bending out at the top. Some varieties are green-culmed; some have a purple-red cast. The branches are short and number more than three at each node and will clothe the culm to the ground unless shaded out. The leaves are bigger and darker than Phyllostachys, so the texture is heavier. The corss-section of the culm is round except for sa slight groove beginning above the branches and ending before the middle of the internode. Culm leaves are deciduous.

It can totally obscure an unwanted view in a narrower space than any other bamboo and do this without pruning. Its cultural requirements are the same as *Phyllostachys*.

Arundinaria Chino 'vaginata varieagata' *with white striped leaves. In section "O" at Woodland Park Zoo.* *photo: Joy Spurr*

Sasa

The sasas are dwarf running bamboos native to Japan. There are many of them, but only two are common to Seattle. The sasas are usually under 6 feet tall and have no more than one branch at a node. They have proportionately large leaves and the culms curve up from the base.

Culture

The sasas are understory plants in Japan, but can grow well when the forest canopy is cut down - in fact they can make reforestation difficult. Plant them in sun for a dense look or in the shade for a leggy appearance.

Uses in the Landscape

As a genus the sasas have high potential in the landscape industry because they form a rapid, dense, highly textured, pest-free groundcover. Those that are 4 to 6 feet would be outstanding highway plants because: 1) they spread rapidly and suppress weeds; 2) their rhizomes mat into the perfect erosion control devise; 3) they can stop gradually a runaway car (as compared to a tree or telephone pole); 4) they recover from damage from an accident easily by sprouting new culms from the mass of rhizomes (as compared to the average woody shrub); 5) they are pest-free; and 6) if push came to shove, livestock can graze on them.

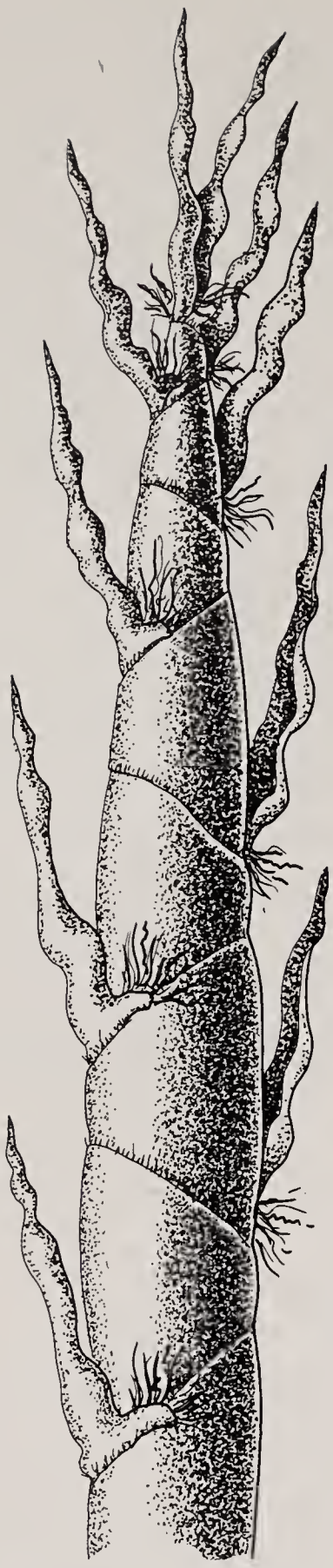
The bold rugged leaves of the sasas also look good in pots.

***S. palmata*,** 12'; 5"; -5ºF

This is the tallest of the sasas. It also has the largests leaves which are up to 15 inches long by 2.5 inches wide and are a rich dark green.

Sasa palmata is known in the Seattle Japanese-American community as 'kuma zasa' ('kuma' means big). It is a desired plant not only for its massive, rugged good looks, but because certain sushi dishes are wrapped in its leaves.

It is a rampant spreader so put it in a large pot or otherwise confine it if in a



Shoot of Phyllostachys nigra *var. 'Henon'.*
drawing by Sylvia Chesley Smith

city lot. Use it by a hot tub to achieve a tropical look. In the country, plant it along a stream for erosion control or plant it outside a pasture. Whenever it moves inside the pasture, your cow will thank you.

S. veitchii, 5';1.25"; 0ºF

This is a striking sasa because when frost touches it in fall the margins of its broad leaves die and turn the color of parchment. It is an excellent accent plant when placed to display the bold texture.

Pseudosasa

P. japonica, Arrow Bamboo 18'; .75"; 0ºF

Pseudosasa japonica has round culms that are round in cross-section. The Japanese use them for arrow shafts. Sheath leaves are persistant. On new culms the culm leaves are light tan and cover three-fourths of the culm and contrast handsomely with the more mature dark green culms. As the culms age, the culm leaves weather to grey and become tattered.

Arrow bamboo has dark green leaves that are darker and bigger than those of *Phyllostachys* but smaller and less textured than *Sasa palmata*. *P. japonica* is less of a runner than the *Sasas, Arundinarias, and Phyllostachys*. Its clumps tend to be very dense with culms jammed against one another. Many plants in Seattle have been flowering and look weedy and awful as the culms die back for lack of leaves.

Culture

Arrow bamboo has no particular demands, but since it can look anywhere from awful to great, it makes sense to give it good soil and plenty of water in hopes of acheiving a healthy appearance. Its leaves will be darker and look better if it is not exposed to hot southwest sun.

Uses in the Landscape

Arrow bamboo is most frequently use as an evergreen hedge. I consider it superior to laurel which quickly becomes too large. This bamboo is naturally narrow and upright, unlike laurel which is a beautiful but round-headed, 40 foot tree.

Pseudosasa can be used to give a tropical or "Japanese" effect. The most attractive way to maintain it is to thin out the old culms to the ground. This way the grove is not a bushy mess and the culms with tattered grey culm leaves are removed. What is left is fresh green leaves and green culms with alternating patterns of light tan culm leaves.

Photography Contest

The following black & white photographs are the winners from a recent photo contest held in honor of the formal opening of the Visitor Center on April 19th, 1986. Entry blanks and posters were distributed all over the Puget Sound area and drew nearly 400 color and/or black & white prints from 149 photographers. The most important rule of the contest was that the photos be taken in the Arboretum. There were two catagories - color and black & white. Five judges, Keith Graham, Don Normark, Mary Randlett, Joseph Scalea, and Joy Spurr chose the "best" 20% of those entered to be displayed at the show and then voted for the four prize winners in each of the color and black & white catagories. On April 19th and 20th, 1,500 people viewed the display and by their votes selected the "Peoples Choice" print in each catagory. Only the black & white winners are reproduced in this issue of the *Bulletin*.

The winners are as follows: 1st - Dennis Brooks, (Untitled), page 13; 2nd - Philip Red Eagle, "Woman in Tea Garden", page 12; 3rd - Irene Sandoy, "Crocus", page 14-15; 4th - Irene Sandoy, "Dew Drops", this page; and People's Choice - Allan Durfy, "Bridge", front cover.

The members of the Arboretum Foundation Executive Board and the Fund Raising Committee would like to thank Carl and Jean Crumb for their countless volunteer hours spent in organizing this very successful show.

Understanding World Climate-
A Treasure Chest Unlocked

DR. CLEMENT HAMILTON

Dr. Hamilton is Assistant Professor of horticultural taxonomy at the University of Washington's Center for Urban Horticulture.

Climatologists and biogeographers have long sought an understanding of the great variation in the earth's climate and its influence on the ranges and evolution of plants and animals. Such understanding is also crucial to the horticulturist who determines what plant material is likely to thrive in a given region. In horticulture we usually use systems of zones, such as the U.S.D.A. map or the Arnold Arboretum system, based on average annual low temperatures. A plant marginally hardy in Arnold Zone 7 (average annual low temperature between 5º and 10º F), for instance, is not a good bet for a location in Zone 5, where it usually reaches -10º to -5º F some time during the year. These zone systems do not provide the additional information we need to determine whether or not a plant will prove hardy in a given area, such as duration of cold seasons, snow cover, rainfall and diurnal and seasonal fluctuations.

However, in the 1960's the German biogeographer Heinrich Walter and his colleagues developed a type of diagram that contains much climate information while remaining easy to interpret. In the

years 1960-67, he and Helmut Lieth edited a great compendium, *Klimadiagramm-Weltatlas*, an atlas of diagrams from 8,000 stations around the world classified into climate types and outlined on individual regional maps.

This is a tremendous source of information that can help us answer in detail such questions as: Why are some plants from New Zealand perfectly hardy here while others are not?; Where does one go in Morocco to find plant material likely to survive in the Pacific Northwest?; and How should a garden be planned so that species with like requirements for temperature and water are grouped together?

In this article I will present the Walter climate diagram system and a few examples of climate types around the world. Future articles will build on this as I focus on particular geographic regions and their plants as represented in the Washington Park Arboretum.

Seattle According to Walter

In order to explain how the diagrams work, I will use the Seattle diagram, number 360 on the North America map (see Figure 1). The horizontal axis (figure 1a) represents the months of the year, January to December for stations in the Northern Hemisphere and July to June in the Southern Hemisphere (since seasons are reversed). On the vertical axis each division equals 10º Centigrade, for the temperature curve, or 20 mm precipitation, for the rainfall curve.(See insert page 21.) The temperature curve (figure 1a) tells us what we all know- the average daily temperature is highest in the summer and lowest in the winter. The precipitation curve (added in figure 1b) shows that we receive a great deal of rain in the winter but much less in the summer. The interaction of the two curves tells us when we experience a relatively humid season (vertical shading in figure 1c) and a relative drought (dotted pattern). When the precipitation goes above 100 mm per month, the area under the curve is colored black and one vertical mark above 100 mm equals 200, not 20, mm.

The horizontal bars across the bottom of the diagram (figure 1c) tell us what months the temperature usually drops below 0º C at least once (diagonal shading) and what months the average daily minimum is below 0ºC (solid black; see figure 2, January in Olympia). The numbers in the lower left corner supplement these bars. The top number, 2.3, is the mean daily minimum of the coldest month, i.e., an average January day sees a low temperature of 2.3º C. The lower number tells us the coldest temperature on record, -16.2ºC.

The remaining numbers complete the explanation. The number in parentheses to the right of the station's name indicates that Seattle's elevation (where the data were taken) is 38 m above sea

Figure 1

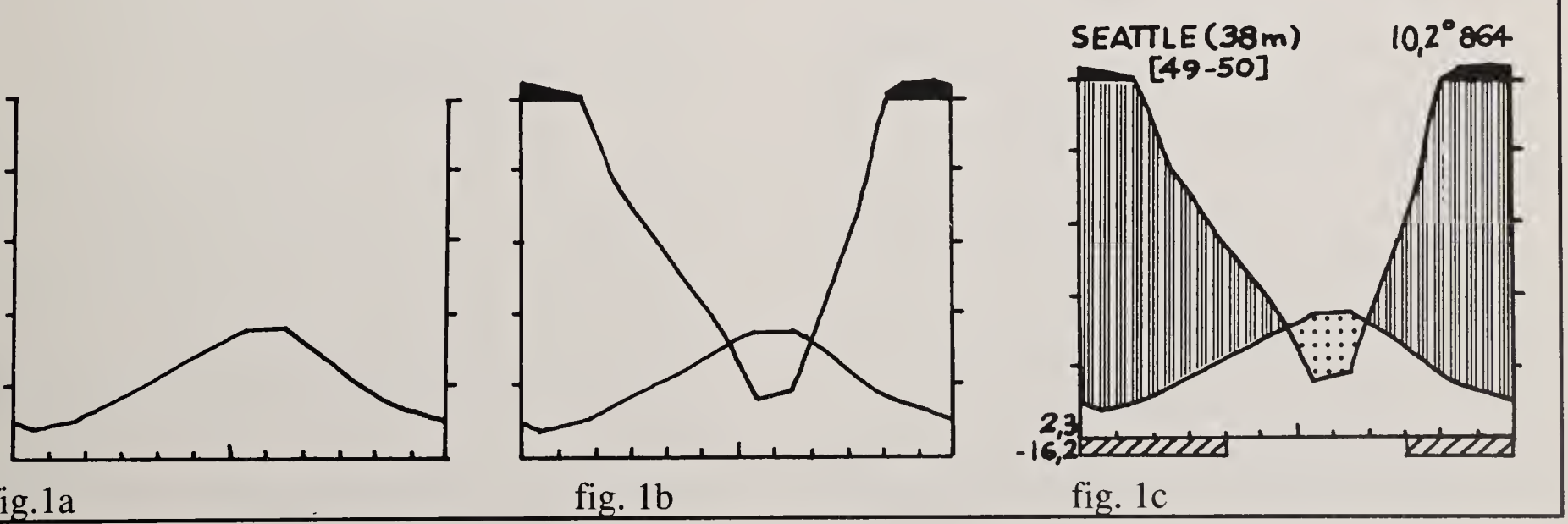


fig.1a fig. 1b fig. 1c

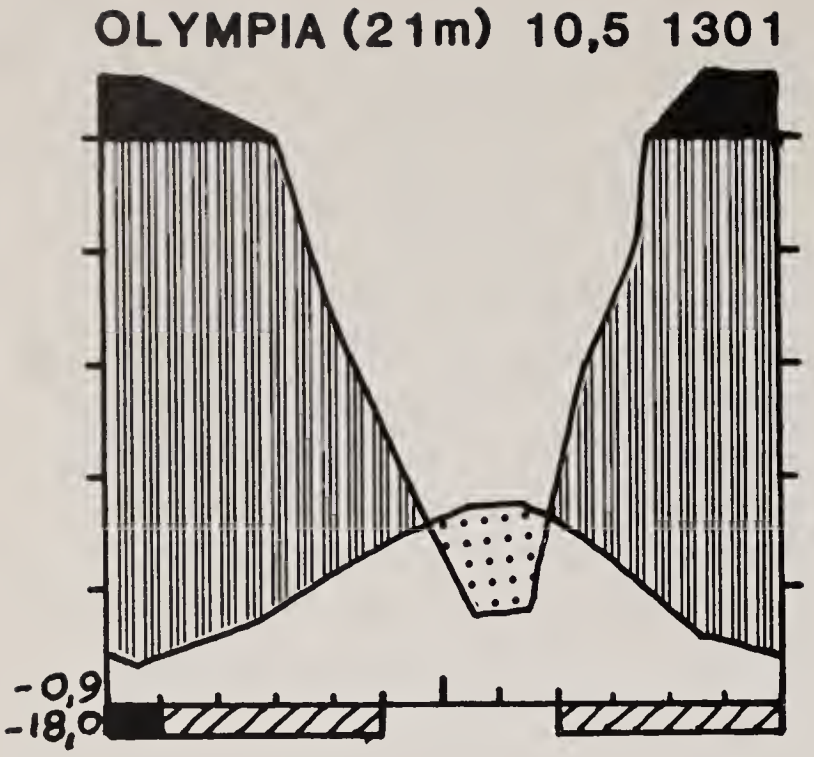


Figure 2

level. The numbers below indicate that the graph is based on 49 years of data for temperature and 50 years for precipitation. The numbers in the upper right corner tell us annual means, i.e., the average temperature here is 10.2ºC and the average annual precipitation is 864 mm.

So, there is quite a bit of information in that small, easily read diagram. The usefulness of this system becomes apparent when comparing locations, such as Seattle (figure1c) with Olympia (figure 2). Olympia has the same general seasonal patterns as Seattle but it receives much more total precipitation (1301 versus 864 mm) and gets colder in the winter (nine months, instead of seven, drop below freezing and one month, January, has a mean *daily* minimum below freezing). Note, however, that Olympia's average annual temperature is 10.5º C, higher than Seattle's 10.2 ºC, suggesting that along with colder winters, Olympia also has hotter summers than Seattle -- obvious to anyone aware of the oceanic influence on Seattle's climate versus the relatively continental influence on that of Olympia.

I hope the reader is now impressed with how much easier it is to obtain information from the chart than to pick it out of a paragraph. The ease with which in-depth climatic comparisons may be made is the real selling point of the Walter system. A word of caution is in order here: the diagrams plot averages and give little indication of variation and extremes. Average annual precipitation may be 864 mm, but some years fall below that and other years exceed it; by how much the diagram does not say. Anyone familiar with Puget Sound's tremendous regional climate diversity also is asking, "Where in Seattle were these data taken?". Even with 8,000 station around the world, each one represents an extensive area that may include much local microclimatic differentiation.

World Climate Types

A brief survey of world climate types illustrates further the use of the diagrams and allows comparison of various regions. The categories of climate zone used here are those of Walter as discussed in the atlas and in his1973 book, *Vegetation of the Earth in Relation to Climate and the Ecophysiological Conditions*. I should mention here that many areas are transitional zones between the following categories and that the zonal classification is a conceptual device. It can be argued even that an entirely different set of zones and their characteristic factors would be more appropriate for horticulturists. As will become evident, the zone definitions are based as much on qualitative patterns as on strictly quantitative parameters. Direct comparison of climate diagrams is necessary in the end for basing biogeographic conclusions and arguments vis-a-vis relative plant hardiness. Here, then, are the nine basic climate zones of the Walter system, with examples chosen from North and Central America.

Zone I. *Evergreen tropical rain forest*, example: Puerto Cabezas, eastern Nicaragua, figure 3. Temperature and rainfall remain generally high throughout the year. Seasonality of rainfall may be present, but without a pronounced dry season. The Amazon basin, west equatorial Africa, and

Indonesia are the largest expanses of evergreen tropical rain forest.

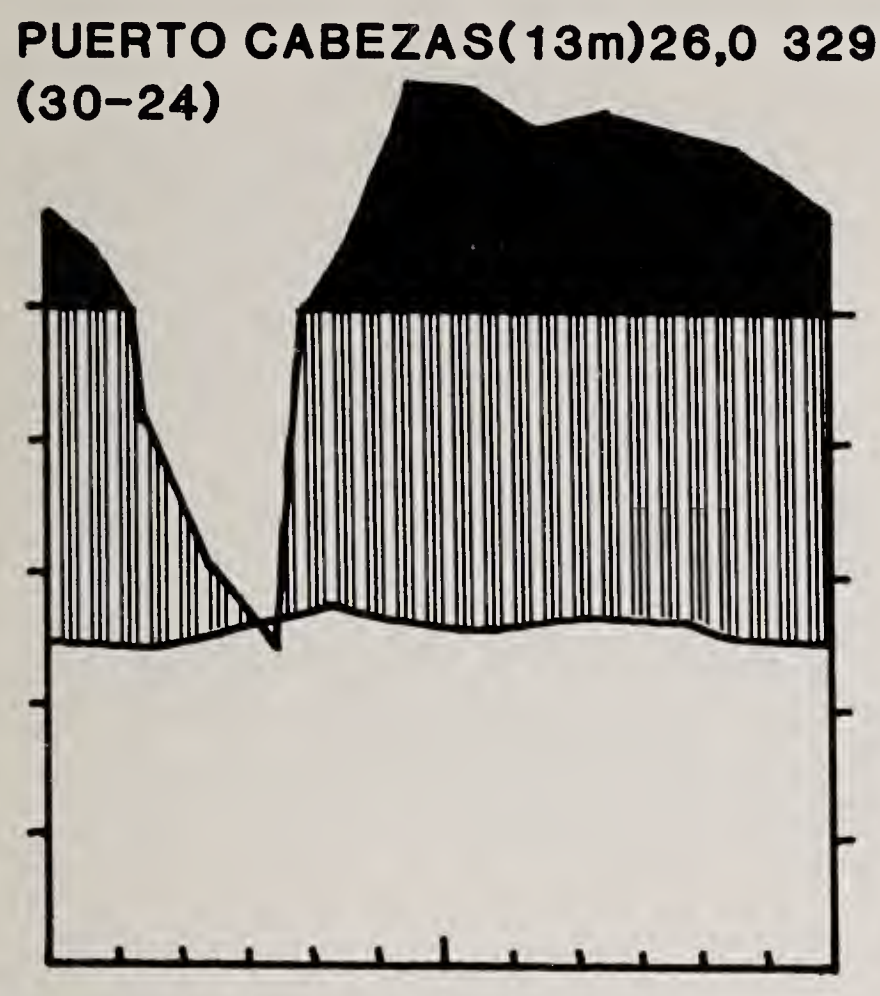


Figure 3

Zone II. *Tropical summer-rain zone*, example: Monterrey, Mexico, figure 4. This zone, which includes tropical and subtropical deciduous forests and savannas, differs from Zone I in having marked seasonality of rainfall with the dry season in winter. This zone is found both north and south of Zone I in South America, Africa, and Asia and also western Central America and Australia.

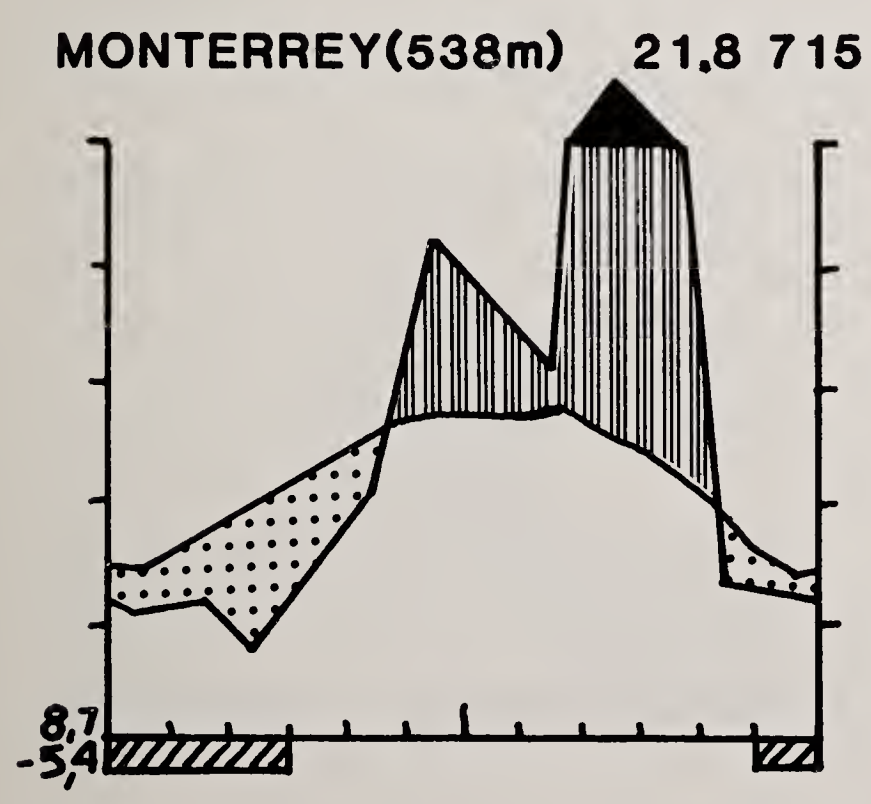


Figure 4

Zone III. *Subtropical deserts and semidesert*, example: Yuma, Arizona, figure 5. As the example illustrates, deserts experience drought condition practically throughout the year and have great seasonal (as well as diurnal) differences of temperature. Not all vegetational "deserts" are climatic deserts. Southwest North America, Pacific coastal South America, Saharan Africa, and Southwest Africa are prime examples around the world.

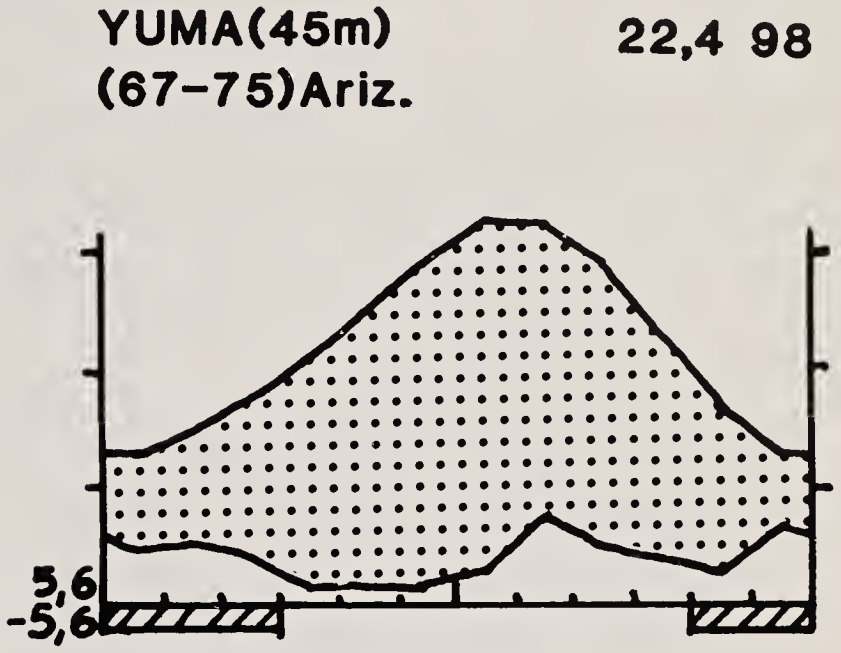


Figure 5

Zone IV. *Sclerophyllous forests of winter-rain regions*, example: San Francisco, California, figure 6 (next page.) This zone, sometimes referred to as having Mediterranean climate, is characterized by winter rain and summer drought. Seattle fits this zone with an element of Zone VI, where the effect of colder winters is evident. Sclerophylly is the phenomenon of thick, often smaller than average leaves. Five Mediterranean regions are parts of Pacific coastal North America, part of the Chilean coast, the Mediterranean itself, the tip of South Africa, and southwestern Australia.

Zone V. *Warm-temperate wet-evergreen forest*, example: Little Rock, Arkansas, figure 7. This zone is characterized as having less precipitation in summer but no drought, and an

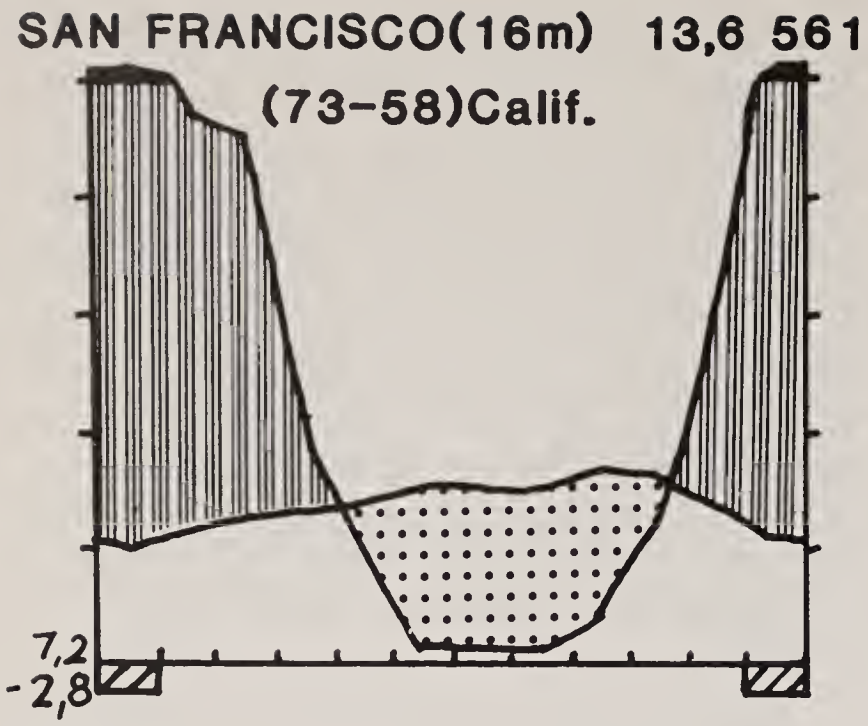


Figure 6

extreme cold season. These regions are typically not large expanses, except for southeastern China and southeastern United States, and often are east coasts at 30º-40º latitudes (e.g. southeast coastal Australia).

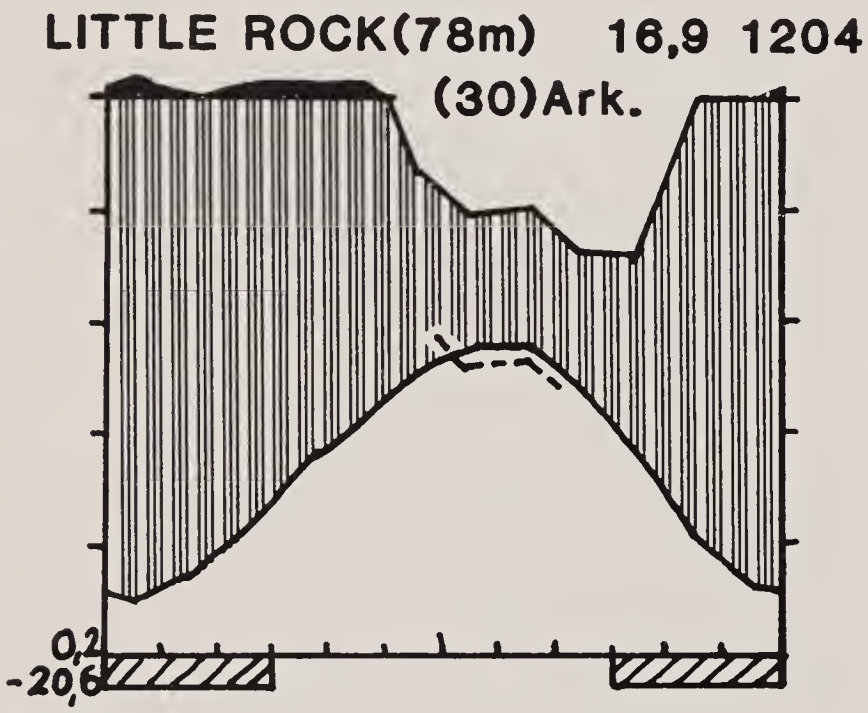


Figure 7

Zone VI. *Deciduous temperate forest*, example: Dayton, Ohio, figure 8. Very cold winters and resultant deciduous vegetation characterize this zone, which is found in much of eastern North America, northern Europe, and northeastern China. Drought is not a regular problem in these zones.

Zone VII. *Winter-cold steppe and desert*, example: Yakima, Washington, figure 9. Cold winters plus a significant drought period, usually in summer, characterize this zone. These conditions are found across Central Asia and in the Western Hemisphere in rain shadows of

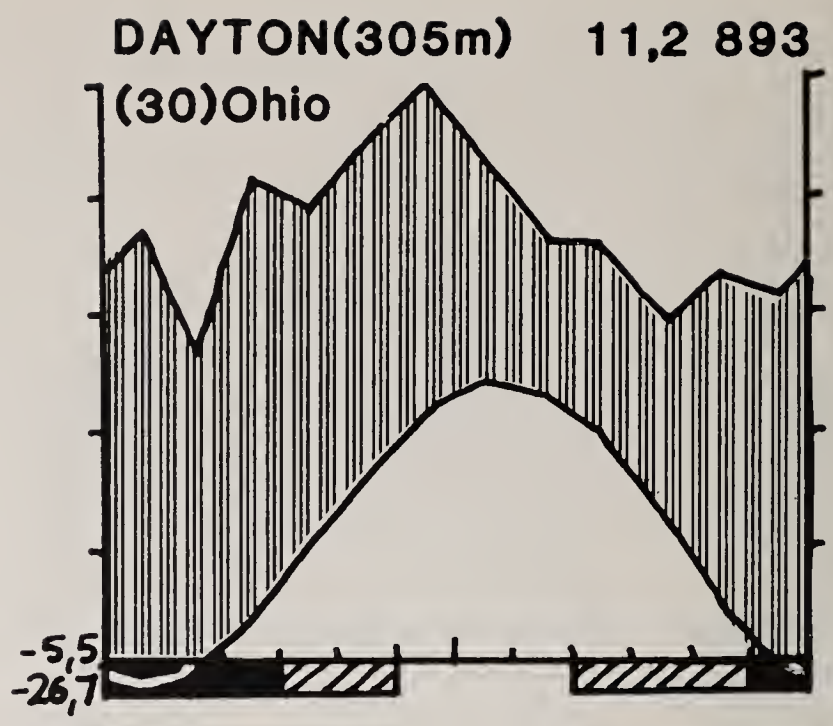


Figure 8

Pacific coastal ranges and the Rockies. This includes, of course, much of eastern Washington.

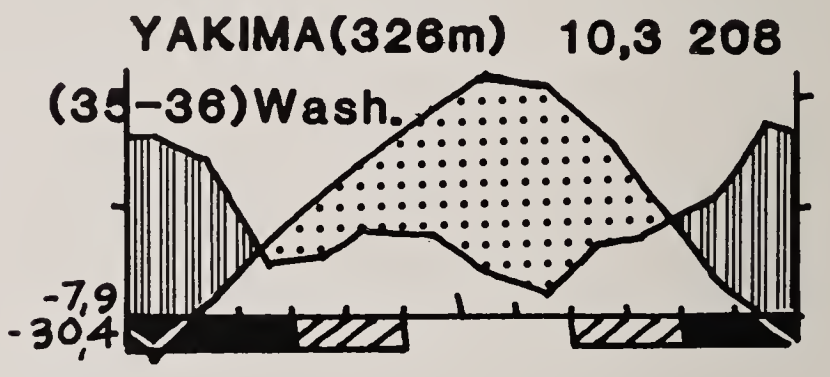


Figure 9

Zone VIII. *Boreal coniferous zone*, example: Edmonton, Canada, figure 10. This zone picks up where conditions, particularly temperature and length of growing season, become too unfavorable for deciduous angiosperms. This zone stretches across the Northern Hemisphere from approximately 50º to 70º N latitudes.

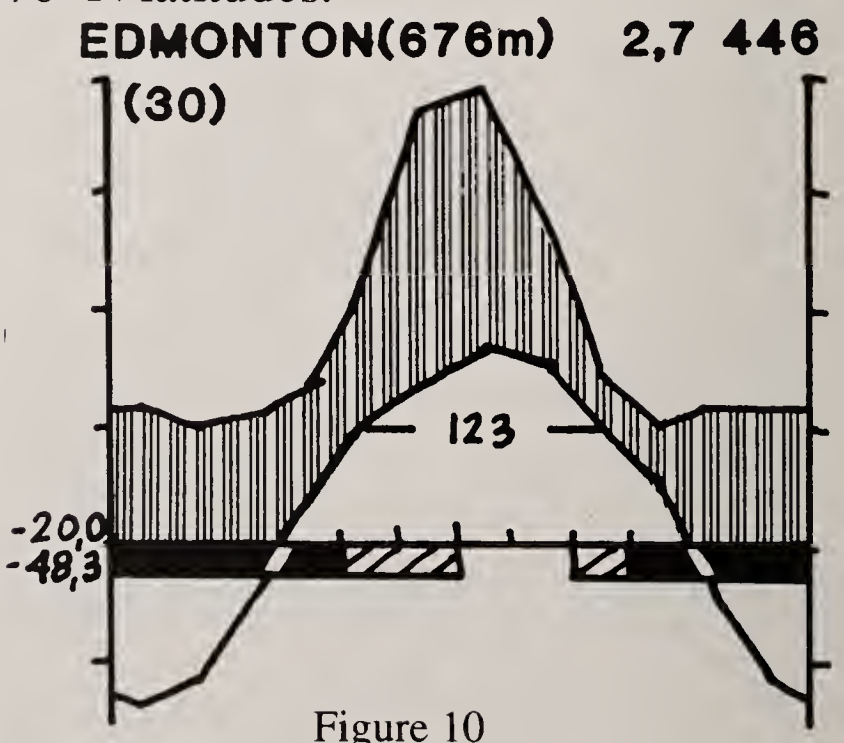


Figure 10

Zone IX. *Tundra*, example: Shishmaref, Alaska, figure 11. Tundra is characterized by temperatures lower yet than thoese of Zone VIII, with at most two months per year when temperatures do not go below freezing. It encompasses all of the arctic region plus the antarctic islands and the tip of South America.

The preceding was a very general survey of world climate variation and an introduction to the Walter diagram system, on which I will draw heavily in future articles. As many have pointed out, a thorough knowledge of native ranges and habitats of plants is crucial when determining how that plant is to be maintained and where in the landscape it should be placed.

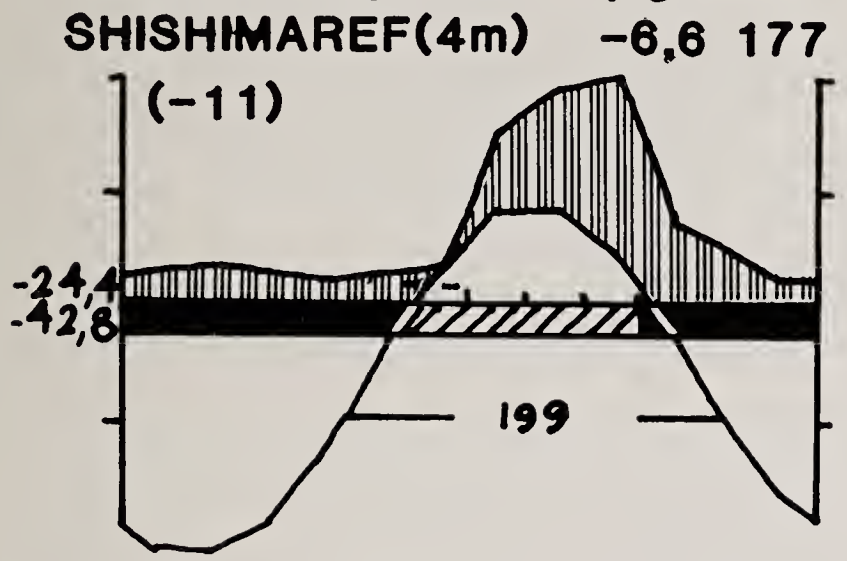


Figure 11

Centigrade? Millimeters?

The Walter system, being scientific and international, uses the metric system for linear measure (precipitation) and the Celsius (centigrade) scale for temperature. For those of us steeped in our traditional inches and Fahrenheit degrees, it helps to know a few tricks for easy conversion. With a little application, these new units become part of one's "measurement intuition".

Centimeters and millimeters are easy. There are about 2.5 centimeters to an inch, 10 millimeters to a centimeter, and therefore 25 mm to an inch. Two inches of rain is 50 mm. If your handspan is 8 inches, that's about 200 mm. A month with 100 mm of rain? That's four inches.

Celsius, or centigrade, temperature is not much more difficult. The freezing point of water is 0ºC (32º Fahrenheit); the boiling point is 100ºC (212ºF). Celsius uses one hundred degrees between freezing and boiling, while Fahrenheit uses 180 (212 minus 32). To go from F to C, first subtract 32 and then multiply by 5/9 (or just over 1/2); 50ºF minus 32 equals 18, just over half of 18 is 10ºC. To estImate from C to F, first multiply by 9/5 (or just under 2) and then add 32; 20ºC times just under 2 is about 38, plus 32 is 70ºF. Practice converting any time you drive past a bank time & temperature sign, and soon you will have the feel for it. Also you can keep in mind that 0ºC = 32ºF; 10ºC = 50ºF (Seattle's average temperature); 20ºC =68ºF (a nice day); and 30ºC =86ºF (a mid-summer "heat wave").

Report from the Director: Plant Collections - The Heart of the Arboretum

HAROLD B. TUKEY, JR.
Director of Arboreta

The main work in the Arboretum, the plant collections, has been moving forward during the planning and construction of the Visitor Center. Several grants totalling $145,000 were awarded by the federal government's Institute of Museum Services; Joyce Brewster, Development Officer, prepared our successful grant proposals.

One grant supported a program of tree conservation and care, the first the Arboretum has had for many years. Arborist Paul Wiltberger, assisted by the Arboretum staff, removed trees which were dead or were a serious hazard to visitors. With great skill, large and multistemmed trees were felled without damage to the collections beneath. We are pleased with his good work. This program made such a great improvement that John Hushagen, a graduate student in Urban Horticulture, was hired half-time as Arboretum arborist. In total, 340 trees have been worked on, which includes removal of150 that were diseased and hazardous, and pruning and thinning 190 others. The results have been impressive with much improved views, more sun to understory plants (some of which have never flowered), and more attractive and healthier trees. If funds can be found, we would like to add permanently a position of staff arborist.

Monies donated by the Arboretum Foundation Unit Council from plant sales were matched by IMS funds to pay for Arboretum staff who were ground support for the arborists and cleaned up wood and debris. The tree program has been a major project for the Arboretum, and we are pleased with the results.

Another benefit to the Arboretum from an IMS grant is the development of interpretive materials, begun in 1985 by David Hancocks, and completed by

Dr. Wott, Mrs. Brewster, Mr. Bobbitt and Mrs. Pirzio-Biroli. A brochure, "The Maples", was written by graduate student Daniel Hinkley as part of his M.S. thesis. The brochure, which is for sale in the Gift Shop, describes some of the most interesting of the Arboretum's fine collection of maples and helps guide visistors to the individual plants. Trail markers have been placed in the Arboretum to match the brochure descriptions. Future students will be encouraged to develop similiar projects with other plants.

The new map of the Arboretum has just arrived from the printer and is also for sale at the Gift Shop. In two colors, it is a great improvement over previous maps both in information and format. Colored enamel enlargements of the map will be placed in several locations in the Arboretum to give information and direction to visitors.

New staff have been added in critical positions. The Curator of Plant Collections, Mr. Timothy Hohn, is responsible for the curitorial staff and will be part of the team which will develop an overall plan for plant collections. Mr. Hohn will act as a plant materials information resource for horticulturists in this area. This position is partially supported by 5-year pledges from the Arboretum Foundation and the Northwest Horticultural Society.

A temporary manager of the Visitor Center, Mr. Eric Nelson, has been hired to schedule activities, work with volunteers, and assist the continuing education program. Mr. Nelson will be at the Visitor Center until the permanent position can be advertised and applicants interviewed. The Unit Council supplied $12,000 in support of this position and the Center for Urban Horticulture added $3,000. Fees from rentals in the Visitor Center will defray future costs. This manager reports to the Office of Continuing Education in Urban Horticulture in order to coordinate schedules between the Visitor Center and Union Bay. Guidelines for use of the Visitor Center have been approved by the Arboretum and Botanical Advisory Committee and scheduling will begin as soon as the contractor is finished with the building and the surrounding site.

Mr. Van Bobbitt has returned to his full time job after a "temporary" stint in the Arboretum Visitor Center for over 2 years. He has responsibility for the landscape maintenance industry series and newsletter, and for public lectures. His good work in the Arboretum is appreciated.

Although the number of persons in the curatorial and maintenance staff has remained the same, the skills of the staff have been upgraded by experience and the addition of new people. Mr. Philip Renfrow, Lead Horticulturist, has come from Russo's Wholesale Nursery where he was foreman for several years. Ms. Barara Engler moved from the campus gardening staff to the Arboretum as Horticulturist II. Mr. Dean Powell, who looks after the greenhouse, was reclassified (promoted) to Plant Technician II; Mr. David Zuckerman and Mr. Robert Hilzinger were both reclassified to Horticulturist II. Mrs. Pirzio-Biroli, who has looked after the curatorial functions of the Arboretum since the passing of Mr. Witt, was reclassified to Research/Extention Program Assistant. Mr. Fred Mauch, Horticulturist II, and Mr. Richard Hart, Supervisor, bring many years of Arboretum experience to their jobs.

Management development of the plant collections, including the mature plantings in the Arboretum and the new plantings at Union Bay is our next major objective. An overall master plan for plant collections has never been formalized since the orginial Olmsted plans. We now have the management team with the skills and interests to develop such a plan, consisting of the director, curator, landscape architect, and faculty in taxonomy, enviromental horticulture, and continuing education.

A statement of goals and objectives for the Arboretum will be drawn up. Together with the staff, we will develop

policies of plant acquisition, maintenance and personnel. Specific projects of improvement and renovation will be selected in cooperation with staff from the City of Seattle Department of Parks and Recreation. As an example, some years ago, the camelia collection was renovated. There are other groups that merit similar attention, such as the hollies, magnolias and plantings along Azalea Way. Plantings around the Visitor Center, including the arbor, and the new plantings at Union Bay will be developed as part of the total collections. Once projects have been identified we will work with the City and others to secure funding.

There is curatorial work in bringing our plant records up to date, verifying names and locations of plants in coorperation with the Hyde Herbarium and computerization of plant records in both outdoor collections and in the nursery and greenhouse. Once identification and verification is accomplished, interpretation of the collections will be emphasized.

The months and years ahead in the Arboretum will be full of challenge and excitement.

Eucyphia cordifolia, *from* A Garden Flora, Trees and Flowers Grown in the Gardens at Nymans. *By L. Messel. 1890-1915. Illustrated by Alfred Parsons.*

Book Reviews

Azaleas, by Fred C. Galle. Published by Timber Press, Portland, Oregon.1985. Price $65.00.

Azalea specialists and gardeners in general have long awaited a new or updated version of Frederic P. Lee's *The Azalea Book*, which was published in 1958. More than 25 years later the Timber Press has produced a monumental volume by one of today's most prominent azalea experts, Fred C. Galle. Originally intended to update Lee's book, the present work is actually an entity in its own right, greatly explanded and totally revised. There are entire sentences which are almost identical to those in Lee's book - this is not mentioned in order to imply plagerism; rather such repetition indicates that, at one time, Mr. Galle planned a revision. The necessity for this approch was inherent in the recent and ongoing revision of the genus *Rhododendron* as well as the explosion of new hybrids that have been developed and named since the late 1950s. The net result stands on its own. It is a magnificent work, highly detailed and well illustrated with color photographs and useful drawings.

The comprehensive listing and description of species and cultivars comprises the bulk of the text (pp. 59-301 out of 486 pages) and is probably that part which will be most valuable to its users. However, many other chapters and appendices have considerable interest. The section on taxonomy and nomenclature helps to clarify changes in classification. The chapter entitled "Azaleas - Plants, Habits, Flowers and Leaves" makes understandable to the reader some of the characteristics which are typical of azaleas, such as the color breaks that occur in the flowers of certain taxa, the standard descriptions of flower form and color, and the variations pecular to azalea leaves. The appendices are equally valuable, although it should have been made clear from the beginning that "Azalea Introductions" (Appendix B) lists the USDA and National Arboretum introductions, and the "List of Registered Azaleas" (Appendix H) is limited to those cultivars which have been registered between 1958 and 1985, since the earlier ones had previously been published by the Royal Horticultural Society. The headings should have been more explicit.

It is this tendency to be less than explicit which is one of the major problems with the book as a whole. It cannot be taken in hand and completely understood from the beginning. Several hours' browsing through the chapters, appendices and indices will make it a more usable tool. At least two problems contribute to initial confusion. First, the table of contents is a mere two pages long and lists only major divisions, and the subject index is equally scanty, thus making it difficult to seek out the information desired. In addition, the headings at the top of each odd-numbered page are equally general; they would be more useful if, for example, "Evergreen Azaleas" could have had a subheading such as "Glenn Dale Azaleas", "Gable Hybrids", etc. It is through the two indexes, the aforementioned subject index and the "Index of Azaleas by Name" that one is enabled to work backward to find one's way around this enormous tome. The latter index is broken down into four sections: I. Azalea Sections and Subseries (p. 447); II. Hybrid Groups (pp. 447-449); III. Species (pp. 448-449); and IV. Cultivars (450-484). Thus, if one is interested in the Robin Hill azaleas, one consults number II and if one is looking for a given cultivar and its relatives, one goes to number IV.

On first picking up the book, this reviewer happened to find a discrepancy in spelling between several entries for Azalea 'Daviesii'; in two instances the second "i" was omitted from the name. During serious perusal of the book, numerous similar errors became

noticeable. In general they occur in spelling of names but in at least one case the photo captions are reversed (i.e. plates 9 and 19). Furthermore, the color photograph of *R. periclymenoides* (plate 11) is upside down and that of 'Broughtonii Aureum' (plate 102) has a white rather than a pale yellow corolla (is it an error or merely a faded photograph?). In addition to being annoying, such problems cast a shadow on the entire work even though the vast majority of entries are certain to be correct. It is unfortunate that such a basically useful and important publication could not have had the proofreading and editorial input that it deserved.

Nevertheless, this is a book that anyone who is interested in azaleas should acquire. No horticultural library should be without it.

Jan Pirzio-Biroli

Manual of Cultivated Conifers, by Gerd Krussmann, edited by Hans Dieter Warda; 2nd revised edition. (Paul Parey, Berlin and Hmaburg, 1983). Translated into English by Michael Epp. (Timber Press, Portland, Oregon, 1985). Price $65.00

The original author of this monumental work, Dr. Gerd Krussmann of Dortmund, West Germany, died in 1980 before completing the revised 2nd edition of his *Manual of Cultivated Conifers*, originally published in 1972. The revision was then resumed by Professor Hans-Dieter Warda, Scientific Director of the Hamburg Botanic Garden. The English translator, Michael Epp, has been a member of the staff of Hillier's famous nurseries in southern England and also worked in the Botanical Garden at Dortmund, West Germany, of which Dr. Krussmann was formerly Director. The technical editor for this translation was Dr. Gilbert Daniels, formerly Director of the Hunt Botanical Library of the Carnegie Institute of Technology at Pittsburgh, Pennsylvania, so that this new production was in excellent hands.

Its magnitude may be estimated from the number of pages (361), photographic plates (160, with 1-4 per page, and figures (225), which vary from small drawings of seeds to reproduced pressings of dried branches to sketches of tree forms. A distribution map, usually rather small in size, is supplied for most genera except those with only a single or very few representatives.

Before reaching the alphabetically arranged descriptions of species and cultivars which make up the body of the work we find hardiness zone maps for Europe, the U.S.A. and southern Canada, and for China; in each case parallel figures in degrees C. and F. are supplied. These are followed by a key to abbreviations for illustrations in other reference works (77 in number), usually in the form of two or three capital letters. Then a "Systematic Outline of the Modern Gymnosperms" and a "Summary of the Characteristics of Gymnosperms Dealt with in this Book (Orders, Families, Genera)". The Order Gnetales is included, but only the Family Ephedraceae is described in the text.

Pages 27 to 326 are filled with descriptions and illustrations of the plants covered, beginning with *Abies* and ending with *Widdringtonia*, some 56 genera in all. Taking the former as an example of the treatment of each, we find first an outline of the genus and its various species (about 40 in this case), grouped into subgenera and sections, followed by a table showing the characteristics of their shooots, buds and leaves. The same is also provided for the spruces (genus *Picea*) and the hemlocks (*Tsuga*), but not for the pines. Then a full description of the tree's botanical characters, the country or coutries where it is native, and references to illustrations in the present and other works are supplied. If the plant has botanical varieties or cultivars these follow in alphabetical order.

Descriptions of botanical varieties are extensive, those of cultivars are usually brief but generally include the name of the originator and the date and place of origin, which are always useful facts.

For illustrations, in *Abies* there are 48 monochrome plates, of which ten were taken in the wild state; two range maps; three drawings of the leaves of European, Asiatic and American species, and four showing cones. With such information available it should now become much easier to identify individual specimens with reasonable certainty. Hybrids are also included. At the end of chapter is a bibliography listing the chief articles or monographs on the genus, which can provide further reading on particular groups or species.

In the genera *Chamaecyparis*, *Cryptomeria*, *Cupressus*, *Juniperus*, *Taxus* and *Thuja* many of the illustrations are of pressed branches, to show differences between the cultivars. These can be very helpful, if taken in conjunction with the descriptions.

An unusual feature of this work is a table of botanical terms in five languages; English, Latin, German, French and Dutch, covering more than seven pages. This is followed by an extensive "Outline of Botanical Terms and their Meanings", describing the various parts of a tree from its habit of growth to its leaves, flowers and seeds. A "Key to Coniferous Genera", by Professor F. H. Meyer, lists the numbers of genera (56), species (607) and forms and cultivars (2,075) described in this very comprehensive and up-to-date work. There is also an "Index to Invalid Plant Names" as well as an index of "Common Names" arranged under genera. In addition is a listing of the "More Prominent Conifer Collections", chiefly in Europe, as might be expected in a German work. On this continent only two in Canada are mentioned, at Ottawa and Montreal. In the United States the Arnold Arboretum, Morton Arboretum, National Arboretum at Washington, D.C., the New York Botanical Garden, Parks at Rochester, New York, and the Strybing Arboretum in San Francisco are included. This list might well have been somewhat extended, at least to include the notable collection of pines in the charge of the U. S. Forest Service at Placerville, California, the Hoyt Arboretum in Portland, Oregon and our own Washington Park Arboretum, with its extensive collections of all kinds of conifers.

It will be evident that this is a most valuable and authoritative work on the cultivated conifers grown in temperate and warm temperate regions of the world, and as such should be in every horticultural and botanical library, for frequent reference and consultation.

Brian O. Mulligan

Dr. Roland Pinkham

Dr. Roland Pinkham, 1st vice-president of the Arboretum Foundation, died April 26 at the age of 74. Although he continued his leadership role in the medical community following retirement from a distinguished career as thoracic surgeon, he found time to devote his considerable talents to the causes and activities of the Arboretum and the Foundation. He is survived by his wife, Mary, a long-time supporter of the Foundation and currently an active director, and by two sons and a daughter.

Cornus x dubia, *flowering in Arboretum border north of E. Lynn Street Bridge.*

Photo: Brian O. Mulligan

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